DEPARTMENT OF NATIONAL DEFENCE
CANADA

OPERATIONAL RESEARCH DIVISION

DIRECTORATE OF OPERATIONAL RESEARCH (CORPORATE, AIR & MARITIME)
&
DIRECTORATE OF STRATEGIC HUMAN RESOURCE CO-ORDINATION

ORD PROJECT REPORT PR2000/07

THE REQUIREMENT FOR MILITARY HUMAN RESOURCE MODELS

by

DR A. JESION

JANUARY 2000

OTTAWA, CANADA

National Defence Défense nationale

OPERATIONAL RESEARCH DIVISION

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102-02189/

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OTTAWA, ONTARIO

JANUARY 2000

ABSTRACT

This report examines a wide range of issues related to military Human Resource (HR) modelling activities as conducted within the Personnel Operational Research Team (PORT). By examining a number of recent case studies, it is demonstrated that there is a strong and ongoing requirement for HR modelling to support military HR policy development in DND. A number of issues and concerns relating to the current state of PORT modelling capabilities are raised. These range from concerns about the technical state of current modelling tools to resource allocation questions to career progression issues within the Defence Scientist (DS) community. This paper provides several recommendations in this regard.

RÉSUMÉ

Le rapport traite d'un large éventail de questions concernant les activités de modélisation des ressources humaines (RH) militaires menées par l'Équipe de recherches opérationnelles en personnel (EROP). Des études de cas récentes ont montré que la modélisation des RH venant en appui à l'élaboration de politiques en RH au sein du MDN est un besoin pressant et continu. Des questions et des problèmes quant aux capacités actuelles de modélisation de l'EROP y sont soulevés. Les sujets traités sont variés, il peut s'agir de l'état technique des outils actuels de modélisation, des questions d'allocation ou de la progression des carrières au sein de la communauté scientifique de la Défense (SD). Le présent rapport comporte plusieurs recommandations à cet égard.

THE REQUIREMENT FOR MILITARY HUMAN RESOURCE MODELS

EXECUTIVE SUMMARY

Background

1. The Department of National Defence (DND) and the Canadian Forces (CF) have made extensive use of Human Resource (HR) models for over forty years. These models have been developed within a branch of Military Operational Research and Analysis previously known under a variety of names such as manpower or personnel analysis. Currently, it is the Personnel Operational Research Team (PORT) which has the mandate to provide operational research and analysis support to DND/CF HR planning staffs with respect to the operation and management of the military HR system.

Key Findings

2. The size and nature of CF military occupations are changing as a result of significant re-structuring and re-engineering during the 1990's. The increasing number of requests for PORT modelling assistance is evidence that the need for systematic, analytical input to support HR policy decision-makers is growing. This paper illustrates this with examples of models applied to the following types of issues:

a. Occupational re-structuring support;
b. Terms of Service analysis;
c. Demographic studies;
d. Support for career management;
e. Database development;
f. Attrition analysis; and
g. Methodological research.

3. Having established that there is an ongoing requirement for military HR modelling, this paper raises a number of issues and concerns relating to the current state of PORT modelling capabilities. These range from concerns about the technical state of current modelling tools to resource allocation questions to career progression issues within the Defence Scientist (DS) community. Suggestions have been made to extend the suite of PORT HR modelling tools and pursue studies in new HR-related areas, providing that resource managers see the need for such activities.

4. The Generic Model building environment (GeM) is the prime tool used within PORT for developing career flow models that support military HR decision-makers at both the strategic and career management levels. Career flow modelling of CF occupations, as conducted in GeM, has achieved a great deal of acceptance among HR planners and career managers. During periods of CF re-structuring and re-engineering, a vast array of personnel systemic transitions are being made - most of which require the unique range of personnel forecasts which GeM models provide to decision-makers.

Recommendations

5. It is recommended that a research project be funded to carry out the substantive analysis required by DND/CF to make an informed decision to either continue the development of GeM as the prime military HR modelling methodology or to develop the equivalent capability in a more supportable environment. Furthermore, it is recommended that a developmental level analyst position be established to become familiar with career flow modelling, alleviate the heavy burden of work which is currently falling upon PORT modellers and to provide succession planning for these analysts.

TABLE OF CONTENTS

	Page No.
ABSTRACT/RÉSUMÉ	i
EXECUTIVE SUMMARY	ii
TABLE OF CONTENTS	iv
LIST OF ACRONYMS	v
I. INTRODUCTION	1
Aims	2
History	2
Scope	3
Caveat	3
II. THE VALUE OF MILITARY HUMAN RESOUCE MODELS	4
CF Restructuring Analyses (MOS Review Example)	4
CF Terms of Service Analyses (Compulsory Retirement Policy Example)	5
Other Strategic Studies (Officer University Degree Policy Example)	7
Demographic Studies (Prediction of the CF Age Distribution Example)	8
Occupational Restructuring (Tactical Acoustic Sensor Operator Example)	10
Strategic Database Development	11
Attrition Analysis	12
PORT Methodological Research	12
III. CLIENTS FOR HR MODELLING	14
The Present	14
The Future	14
IV. THE GENERIC MODEL (GeM) UTILITY	15
Introduction	15
GeM History	15
GeM Funding	16
GeM Concerns	16
Resource Issues	17
DS Career Progression Issues	18
V. SUMMARY	19
VI. RECOMMENDATIONS	20
REFERENCES	21

LIST OF ACRONYMS

ADM HR-Mil	Assistant Deputy Minister Human Resources - Military
ADM Per	Assistant Deputy Minister Personnel (now ADM HR-Mil)
AMOR	Annual Military Occupational Review
CAS	Chief of Air Staff
CDS	Chief of Defence Staff
CF	Canadian Forces
CMS	Chief of Maritime Staff
CRA	Compulsory Retirement Age
CS	Computer Systems Administration (classification)
DGCB	Director General Compensation and Benefits
DGMC	Director General Military Careers
DGMHRPP	Director General Military Human Resource Policy and Plans
DGOR	Director General Operational Research
DHRIM	Directorate of Human Resources Information Management
DHRRE	Directorate of Human Resource Research and Evaluation
D Man A	Directorate of Manpower Analysis
DMGIEE	Directorate of Military Gender Integration and Employment Equity
DMHRR	Directorate of Military Human Resource Requirements
DMS	Directorate of Mathematics and Statistics
DND	Department of National Defence
DOL	Directorate of Official Languages
D Pers Pol	Directorate of Personnel Policy
DPIS	Directorate of Personnel Information Systems (now DHRIM)
DRAE	Defence Research Analysis Establishment (later ORAE)
DRET	Directorate of Recruiting, Education and Training
DRB	Defence Research Board
DS	Defence Scientific Services (classification)
DSEA	Directorate of Social and Economic Analysis
DSHRA	Directorate of Strategic Human Resource Analysis (now DSHRC)
DSHRC	Directorate of Strategic Human Resource Coordination
ECS	Environmental Chiefs of Staff
GeM	Generic Model building environment
HR	Human Resource(s)
IE	Intermediate Engagement

LIST OF ACRONYMS (continued)

IPS	Indefinite Period of Service
LRPM	Long Range Planning Model
MND	Minister of National Defence
MOC	Military Occupation
MOS	Military Occupational Structure
NAC OP	Naval Acoustic Operator
NCM	Non-Commissioned Member
NDHQ	National Defence Headquarters
OCEAN OP	Oceanographic Operator
OCP	Occupation Change Proposal
OCTP	Officer Candidate Training Plan
ORAE	Operational Research and Analysis Establishment
OSIP	Occupational Structure Implementation Plan
PART	Personnel Analysis Research Team (now PORT)
PORT	Personnel Operational Research Team
PRT	Personnel Research Team (now DHRRE)
QOL	Quality of Life
RAD OP	Radio Operator
SAS	Statistical Analysis System
TASK	Trade Advancement for Skill and Knowledge
TAS OP	Tactical Acoustic Sensor Operator
TEL OP	Teletype Operator
TIR	Time in Rank
UCS	Universal Classification Standard
YOS	Years of Service

THE REQUIREMENT FOR MILITARY HUMAN RESOURCE MODELS

I. INTRODUCTION

1. The Department of National Defence (DND) and the Canadian Forces (CF) have made extensive use of Human Resource (HR) models for over forty years. These models have been developed within a branch of Military Operational Research and Analysis previously known under a variety of names such as manpower or personnel analysis. Currently, it is the Personnel Operational Research Team (PORT) which has the mandate to provide operational research and analysis support to DND/CF HR planning staffs with respect to the operation and management of the military HR system. This broad mandate would include mathematical, statistical, modelling, simulation and other types of analytical studies to examine both short-term and long-term implications of military HR policies[1].

2. All military HR policies, to a greater or lesser extent, have an effect on the CF. This in turn affects the ability of the CF to carry out assigned roles, missions and tasks. In the broadest sense, military HR policies include both current and proposed standards, requirements, procedures, terms of service, rules, etc. when applied to the management of HR issues such as intake, training, career management, force demographics, HR costs, attrition, etc. At various times, HR models have been developed and applied to address all of these issues.

3. PORT's contribution to this process is the analysis of HR policies to support and advise HR planning staffs, primarily within the Assistant Deputy Minister – Human Resources - Military (ADM HR-Mil) Group, about decisions that they face concerning the effective and efficient management of the CF. The analysts assigned to PORT have a number of tools that they can employ to carry out their mandate. These range from the spreadsheets and database applications found in any standard office software suite to sophisticated, commercial software packages such as SAS (Statistical Analysis System) and "one-of-a-kind" tools developed specifically for HR modelling such as GeM (the Generic Model building environment). More will be said about GeM later in this paper.

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1 At the moment, no civilian HR models are in use or under development within PORT, although this has not always been the case in the past. There is nothing in principle that precludes PORT from developing and applying civilian HR models.

Aims

4. This paper has a number of aims. First, the paper will demonstrate how HR modelling has supported decision-makers in DND/CF in the recent past to illustrate the utility of HR models. Next the paper will discuss a number of issues and concerns relating to the current state of PORT modelling capabilities. Finally, the paper will make a number of suggestions for a "way ahead" for HR modelling support in the future.

History

5. The Defence Research Board (DRB) provided Operational Research and Analysis support to DND and the CF after World War II through the Defence Research Analysis Establishment (DRAE). DRAE's Directorate of Mathematics and Statistics (DMS) was frequently called upon to provide what was eventually to become known as manpower analysis support to personnel system managers to the extent that a Manpower Operational Research Team was set up. The work of this team was so highly regarded that eventually a full directorate was established to carry out this work: the Directorate of Manpower Analysis (D Man A). D Man A continued to work on personnel issues following the transition of DRAE to the Operational Research and Analysis Establishment (ORAE) in the mid-1970's. Following the dis-establishment of ORAE in the mid-1990's, D Man A was effectively transferred to the (then) Assistant Deputy Minister Personnel (ADM Per) Group with the Defence Scientific (DS) staff continuing to be career managed by the Director General Operational Research (DGOR).

6. D Man A eventually ceased to be a directorate, although its research program and DS staff continued to be part of the DGOR organization under a variety of names such as the Personnel Analysis Research Team (PART) before being renamed the Personnel Operational Research Team in 1996. In addition to "manpower modellers", other PORT staff trace the history of their research activities back to another ORAE directorate: the Directorate of Social and Economic Analysis (DSEA).

7. DS positions in PORT have been organizationally attached to directorates within the ADM HR-Mil Group since the dis-establishment of D Man A. These have included the Directorate of Personnel Policy (D Pers Pol); the Personnel Research Team (PRT); the Directorate of Human Resource Requirements and Evaluation (DHRRE); and the Directorate of Strategic Human Resource Analysis (DSHRA) which has recently been renamed the Directorate of Strategic Human Resource Coordination (DSHRC).

8. There are three DS "modeller" positions (funded by DGOR) within DSHRC filled on a rotational basis by "analyst/generalist" DS staff. Also, there are two DS "specialist" positions within DSHRC (one funded by DGOR and one funded by ADM HR-Mil). Currently, there are two client-funded PORT positions within the ADM HR-Mil Group that are outside DSHRC. One is located in the Directorate of Military Gender Integration and Employment Equity (DMGIEE) and the other in the Directorate of Official Languages (DOL). The DS incumbents of these positions are also career managed by DGOR and they are considered "HR modellers".

9. Other organizations such as the Chief of Air Staff (CAS) and the Chief of Maritime Staff (CMS) have military and DS staff who carry out HR modelling activities, often in close cooperation with PORT analysts. However, PORT retains the prime responsibility for the development and application of military HR models within DND and the CF.

Scope

10. This paper makes reference to research recently published by PORT. Military HR models have been developed and applied by other organizations within DND, but these are outside the scope of this particular paper. However, coordination of DND HR research activities, both inside and outside of DGOR, is desirable from the perspective of efficiency and effectiveness.

Caveat

11. The opinions expressed within this paper and the recommendations made are the sole responsibility of the author and do not necessarily reflect the opinions of other authors of papers listed as references here.

II. THE VALUE OF MILITARY HUMAN RESOURCE MODELS

12. In this section, some recent examples of PORT modelling activities are described in order to illustrate the value of having this type of support for military HR policy development and management. Examples are given for models applied to the following types of issues:

a. Occupational re-structuring support;
b. Terms of Service analysis;
c. Demographic studies;
d. Support for career management;
e. Database development;
f. Attrition analysis; and
g. Methodological research.

CF Restructuring Analyses (MOS Review Example)

13. The size and nature of CF military occupations are changing as a result of significant re-structuring and re-engineering during the 1990's. The strength of the CF has been reduced to 60000 with many positions remaining unfilled. Military occupations (MOCs) are being examined on a regular basis with a view towards achieving efficiencies by either amalgamation or elimination of MOCs. Also, change may be required to deal with demographic or MOC structural problems, new technologies, new operational requirements, etc. In these matters, HR models can be of assistance by providing decision-makers with relevant information about current issues/situations as well as the possible implications of various courses of action under consideration. A recent example of such support is the PORT study of "rank inversion" carried out in conjunction with the Military Occupational Structure (MOS) Review.

14. PORT was requested by the Director Military Human Resource Requirements (DMHRR) to develop HR models of military occupations that have "rank inversions".[2] Twenty Non-Commissioned Member (NCM) occupations were identified by the MOS Review as having rank inversion in one form or another. In particular, the sustainability of affected occupations was to be analyzed using PORT HR simulation models. Results for this analysis were published in Reference 1.

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2 "Rank inversion" occurs when the population size at a particular rank in an occupation exceeds the population in a lower or "feeder" rank.

15. Using both quantitative observations and qualitative arguments, the MOCs affected by rank inversion were classified in Reference 1 as follows:

a. MOCs which have little or no systemic sustainability problems in the inversion ranks and which should not require any remedial action (GREEN);
b. MOCs which have short term or intermittent sustainability problems which may require remedial action (AMBER); or
c. MOCs which have severe sustainability problems and definitely require remedial action (RED).

16. Reference 1 results were used by the sponsor to identify those occupations which require early intervention. The study showed that the 20 NCM occupations with rank inversions face considerably different long-term viability problems. That is, certain occupations face irregular promotion flows and possible experience gaps as a result of their particular rank inversion situation while others are borderline. Remedial action may not be required at all for some "rank inverted" occupations because the forecast situation will either stabilize or improve naturally (i.e. without intervention). In summary, the type of "triage" provided by Reference 1 is important because of limited resources being available for detailed examination by managers within the HR-Mil Group. Such studies allow both planners and analysts to focus their attention on the highest priority cases first.

CF Terms of Service Analyses (Compulsory Retirement Policy Example)

17. The ability of senior DND/CF managers to run the military HR system in an effective and efficient manner is directly tied to military Terms of Service policies. These policies also affect the quality of life for military personnel. HR policies for issues such as engagement contract types, contract conversion "gates", Compulsory Retirement Age (CRA), etc. affect either directly or indirectly almost every aspect of military life. For example, a decision to reduce the number contract conversions from Intermediate Engagement (IE) to Indefinite Period of Service (IPS) in an occupation has the direct effect of changing the demographic profile of experienced personnel in that occupation. This in turn may affect promotion opportunities depending on intake and training constraints for that MOC. Subsequently, if promotion chances improve, morale in the affected occupation may also improve and have the effect of decreasing voluntary attrition rates. In such a situation, a "younger" demographic profile may contribute to

improved operational effectiveness provided that the training capacity within the occupation is sufficient to provide appropriate training and developmental opportunities for personnel to fill vacancies within leadership ranks.

18. A recent example of a PORT study in this area relates to the CRA policy of the CF. PORT was asked by DHRRE to carry out an assessment of the implications of the elimination of the CRA. This analysis made use of a new version of the Long Range Planning Model (LRPM) based on simulation techniques (i.e. distinct from the D Man A approach which employed a "Stock and Flow" methodology).[3]

19. Reference 3 reported the results obtained by applying the new LRPM to the assessment of the implications of changing the CRA policy within the CF. It was determined that the elimination of the CRA may have a negative impact on a limited number of occupational groups at certain rank levels. However, model results in general indicated that the CF would not be severely affected. Removal of the CRA (without changing pension entitlements) would not significantly alter the age distribution of the CF and the average number of annual releases and promotions for most CF members - under the current Terms of Service. Nevertheless, annual intake would be expected to decline. If the CRA were to be eliminated at the same time that pension entitlements were delayed, then the study predicted adverse effects on the CF age distribution, promotion rates, release rates, and annual intake.

20. The CRA policy project is representative of the type of expert analytical studies which PORT provides to clients who require a rigorous examination of the implications of proposed HR policies before they are implemented. By conducting various model excursions (i.e. a form of sensitivity analysis), experienced analysts conduct research to refine policies and eliminate proposals that cause problems in favour of options that produce more desirable outcomes. Any HR measures of effectiveness can be used as the metric for these assessments. These range from scalar measures such as intake and releases through measures associated with Years of Service (YOS) or Time in Rank (TIR) distributions to more subjective measures of operational effectiveness on a "global" basis.

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3 See Reference 2 for a discussion of these approaches.

Other Strategic Studies (Officer University Degree Policy Example)

21. With the devolution of some military HR management functions from the ADM HR-Mil Group to the Environmental Chiefs of Staff (ECS), PORT modelling activities centre on strategic issues.[4] Meanwhile, there is an ongoing requirement to examine tactical issues, particularly in the occupations "controlled" by ADM HR-Mil. That is, PORT remains responsible for the development of HR models that represent occupational groups that fall outside the purview of a single environment. During this "tactical" work, certain patterns (e.g. predicted promotion rates and population distributions) have been identified that could be of major concern to HR managers, both inside and outside of the HR-Mil Group.

22. PORT regularly examines non-traditional strategic issues, both in the time and scope senses, using analytical tools developed for tactical analysis of career flows. An example of such synergy is the PORT study that followed from the Minister of National Defence (MND) policy that all CF officers have a university degree in the future.

23. Reference 4 provided an analysis of the (then) current CF officer database, reporting on the numbers of personnel in each MOC who hold university degrees. This information was correlated with other factors such as rank, age, engagement type and entry plan to provide some insights into the implications of the policy that all CF officers have a university degree. It was shown that while the professional/technical MOCs would have few difficulties adapting to this policy, most operational MOCs would experience problems implementing an "all university degree" officer corps, particularly if the transition period is short.

24. A further request for modelling assistance in this area was received from the Directorate of Recruiting Education and Training (DRET) concerning Officer Candidate Training Plan (OCTP) policy options. In this study (documented in Reference 5), a smaller number of officer occupations were modelled in greater detail to examine officer entry plans with particular emphasis on estimating the implications of reducing or eliminating the intake represented by the OCTP. Modelling focussed on seven operational MOCs that were identified in Reference 4 as having potential problems if the OCTP were to be eliminated. The MOCs identified include Armour, Artillery,

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4 For the purposes of this paper, "strategic HR models" can be defined as those models which represent all (or substantial numbers of) military personnel in all environments at once. The temporal dimension also makes some models "strategic".

Infantry, Air Navigator, Pilot, Aerospace Equipment Control, and Maritime Surface and Subsurface. It was determined that if the OCTP intake was eventually replaced via other entry plans, then forecast personnel shortages would disappear eventually for all these MOCs except Pilot.

25. The officer university degree study was a project carried out in two phases: one emphasizing data analysis and the other modelling. The first part of the analysis identified the scope of the problem so that the second part (being more labour-intensive) could be more focussed on those occupations most affected by the policy. It should be noted that "single environment" occupations identified as problematic had to be modelled by PORT analysts, even though they fall outside the mandate of ADM HR-Mil, because the root issue under review was of a "strategic" CF-wide nature. There can be inefficiency (i.e. redundancy) associated with having different groups within DND modelling the same MOCs - often with the same tool.

Demographic Studies (Prediction of the CF Age Distribution Example)

26. Another type of strategic HR analysis often requested from PORT concerns current and forecast demographic characteristics of the entire CF or various segments of the CF. Although CF demographic information is available from sources such as the Directorate of Human Resources Information Management (DHRIM), certain types of historical data from years before the "PeopleSoft" transition are unavailable currently, except from PORT analysts. (The PORT strategic database is discussed in a separate section below.) Also, no other organization provides clients with long-range forecasts of demographic profiles of single or multiple occupations, taking into account all relevant military career management policies.

27. Recently, the office of the Chief of Defence Staff (CDS) requested a forecast of the age distribution of the CF, assuming current HR policies and staff levels remain in effect. This information was needed as background material for the CDS appearance before a parliamentary committee. The analysis was carried out as a top priority with the subsequent publication of Reference 6 providing documentation of the modelling methodology used in addition to the results previously provided to the office of the CDS.

28. Some results from Reference 6 are reproduced in Figures 1 and 2 on the next page. These results indicate that, relative to the 1997 age distribution, a dip or "age gap" is developing in the NCM population (with similar findings for the officer

population). The CF may have to live with this dip for decades as a result of recent recruitment levels that are insufficient to fill the personnel pipeline. As noted in other PORT analytical studies, lower than steady-state intake invariably leads to distortions in the CF age distribution. With the "damage" having been done, it will be difficult to counter this problem with subsequent remedial action.

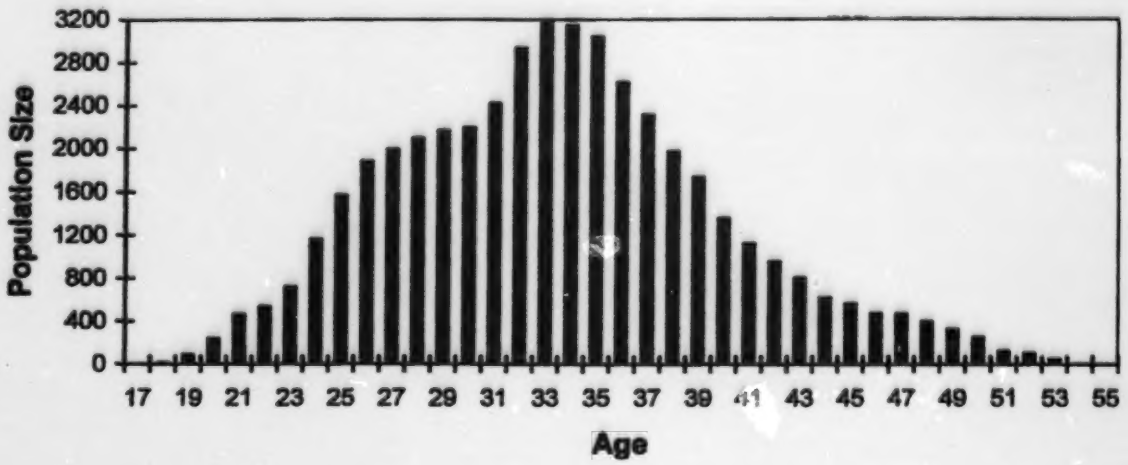

Figure 1: The CF NCM Age Distribution as of 1 April 1997

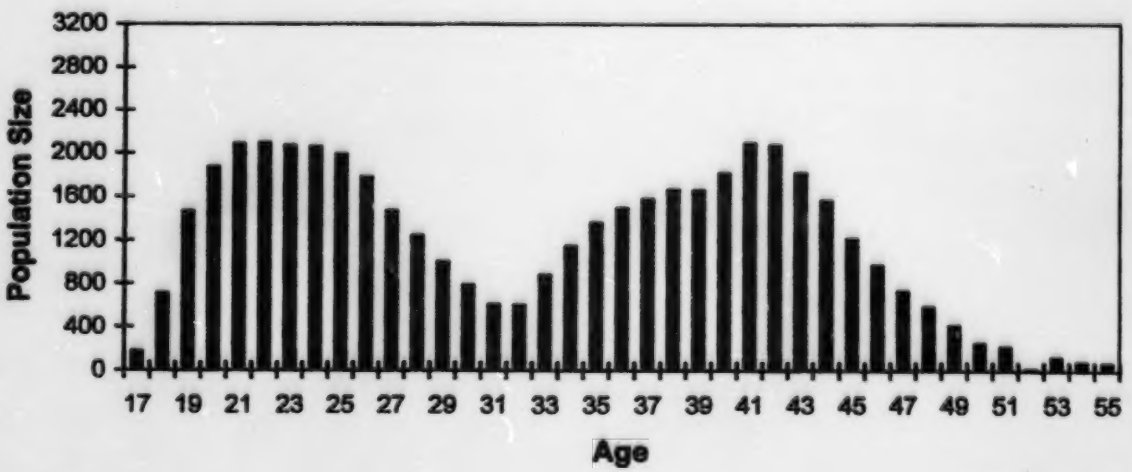

Figure 2: Forecast CF NCM Age Distribution for 2007

Occupational Restructuring (Tactical Acoustic Sensor Operator Example)

29. As a result of CF re-engineering, new occupations are being proposed and approved at an unusual pace and modelling such proposals has become a major activity within the PORT. Reference 7 demonstrates the approach taken by PORT analysts to model new military occupations. The analysis carried out in support of the Tactical Acoustic Sensor Operator (TAS OP) occupation is representative of similar studies, either ongoing or completed for other clients.

30. In this particular study, maritime HR planners identified many areas of similarity between the Naval Acoustic Operator (NAC OP) Military Occupation (MOC) 273 and the Oceanographic Operator (OCEAN OP) MOC 191. An Occupation Change Proposal (OCP) was sent from the CMS to National Defence Headquarters (NDHQ) stating his intention to stand up a new occupation 1 January 1999. In September 1997, ADM HR-Mil directed his staff to initiate preparation of an Occupational Structure Implementation Plan (OSIP) for TAS OP - MOC 278. In support of the TAS OP OSIP, PORT was requested by DMHRR to develop a HR model of the proposed MOC to examine any long-term demographic trends that might adversely affect the viability of this new MOC.

31. It should be noted that CMS does have a limited MOC modelling capability, but PORT support was requested because CMS personnel were fully occupied at the time with Annual Military Occupational Reviews (AMORs). A model for TAS OP was developed and run, with results made available to the client for inclusion in the final OSIP report. It was concluded in Reference 7 that the new TAS OP occupation will be viable despite a scheduled staff reduction.

32. PORT maintains an inventory of tools which includes a career flow model for each occupation and family of occupations in the CF, although each model is not updated each year. Revisions to model structures and data inputs are done as required because the volume of requests for work exceeds PORT's ability to satisfy all potential clients. The primary clients for PORT military occupational models are the staffs of the Director General Military Human Resource Policy and Plans (DGMHRPP) and the Director General Military Careers (DGMC). Also, Medical, Dental, Security, Intelligence, Chaplain, Logistics, Legal and Communications Electronics Branch Advisors have requested modelling assistance in the past year alone.

Strategic Database Development

33. To perform mandated tasks, PORT analysts require access to CF HR data. These data are required for the full spectrum of PORT studies as certain types of available data are often analyzed to infer trends and to develop the input data set needed for running military HR models. For example, career flow models require considerable input data about the current CF population demographics such as age, rank, MOC, year of entry, entry plan, etc. Also, required data are organized to infer recruitment, promotion, attrition, and engagement conversion rates for occupations being modelled. Each MOC model is governed by "rules" which must be either developed from historical CF patterns, inferred from other sources, or just based on the analyst's best guess. In almost every PORT project, obtaining relevant data in the proper format is the first (and perhaps the most important) step.

34. As noted previously, DND is reworking its personnel information framework and this has meant a reduction in the level of support to the legacy data systems - the main source of personnel data for PORT activities. The "Datamart", the data warehouse legacy information compatible with PeopleSoft, is still not able to provide historical data for analytical studies. Moreover, reductions within DGOR have meant the loss of a Computer Science (CS) position associated with the retrieval of HR data from the legacy and "Datamart" systems. As demand for PORT modelling support is increasing, it is clear that PORT analysts require assistance with database management.

35. In this climate, PORT DS analysts have invested the time to develop and maintain a strategic CF personnel database for the desktop computer environment. This database was first developed using raw data from the former Directorate of Personnel Information Systems (DPIS) formatted for the DND database standard - Microsoft Access. As described in Reference 8, the original database contained both officer and NCM information, spanning the period 1982 to 1997. Now updated with 1998/99 information, the database is relatively easy to use and constitutes an important resource for PORT analysts as well as their clients. (It should be noted that this desktop computer database is not intended as a replacement or duplication of the definitive database now maintained by DHRIM. The PORT HR database was designed and implemented as a research tool, with primary emphasis on the facilitation of analytical studies that are the mandate of PORT.) Reference 8 includes four sample studies to demonstrate the utility of the PORT database for both strategic and occupation-specific applications.

Attrition Analysis

36. As noted previously, an important input for HR models is the representation of attrition patterns for the military occupations being modelled. In many cases, historical attrition patterns are unavailable in the proper format for modelling. For example, when two MOCs are being amalgamated, historical attrition data from both MOCs must merged in some fashion to represent in a logical fashion what might be expected for the combined occupation in the future. A recent example of such an attrition analysis can be found in Reference 9. In this study, a statistical analysis of historical attrition rates for the Radio Operator (RAD OP) and Teletype Operator (TEL OP) was carried out to support the development of a career flow model for a new "combined" occupation.

37. Reference 9 demonstrated that historical attrition rates for the RAD OP occupation are "higher" than for the TEL OP occupation, but these higher rates are found at the lower ranks and experience levels only. The TEL OP occupation has a significant proportion of female members when compared to the (current) RAD OP occupation. Reference 9 also demonstrated that historical attrition rates for male and female members of the TEL OP occupation are not significantly different, except at the lower ranks and experience levels where female attrition rates have been higher.

38. The methodology employed in analyses such as the one described above can and have been applied to similar studies being carried out by PORT for other clients. There is considerable synergy between various modelling activities, even when the subject areas are unrelated at first glance. Clearly, by concentrating HR analysis resources, benefits/efficiencies may be obtained by applying "lessons learned" in one study to other work in progress.

PORT Methodological Research

39. DS analysts assigned to PORT continue to carry out methodological research to develop, document and extend their analytical tools. This is an important aspect of the work that serves to keep team members responsive to new technological developments and able to maintain productivity levels in the face of increasing demands for studies with limited resources. One recent example of this was the development of a new LRPM, previously mentioned above (Reference 2). Fortuitously, as this methodology was being developed, a request for assistance was received which could be addressed directly with the new methodology, resulting in a quick turnaround for the client (i.e. Reference 3).

40. PORT and its predecessors have made a continuing investment in the GeM utility that is used to generate career flow models for a wide variety of clients within the HR-Mil Group as well as for the three ECS. The evidence that this investment has paid off is the large number of completed analytical studies carried out in the intervening years. However, as a result of NDHQ reductions, it has been proposed that more HR modelling be done by ECS staff and MOC career managers. In this approach, PORT staff would remain involved in fundamental research and development of HR models, but carry out fewer line applications of the methodology.

41. One example of PORT methodological research in this regard is a study carried out to examine the variability of model results with respect to the choice of random number seeds in GeM simulations. Reference 10 documented an investigation of the nature of this variability with respect to a wide range of possible measures of HR system performance for a representative GeM simulation. Emphasis was placed on identification of robust measures that can be extracted from a single simulation run. It is unlikely that such a study would be carried out by sponsors/clients as they are primarily concerned with results and not modelling techniques per se. Thus, to ensure the quality and reliability of HR modelling, DND requires a central repository of HR model developers who maintain high standards of modelling excellence. This core HR modelling community would be resident in PORT.

42. Methodological research and development is an investment in the future. Time spent on these activities contribute to the "technological base" of DGOR analytical tools. Although the value of PORT methodological research may not be apparent to all clients on a short-term basis, it has been this type of investment in the past that makes current HR modelling activities possible. Innovative solutions to past HR modelling problems have led to the modelling efficiencies now demonstrated in PORT and this trend can be expected to continue in the future if a positive environment for HR model research and development is maintained.

III. CLIENTS FOR HR MODELLING

The Present

43. Currently, career flow models are employed to analyse military HR policies and forecast demographic characteristics for strategic policy development within the HR-Mil Group. Prime clients are DGMHRPP and DGMC staffs as well as DSHRC. Support is being given to the MOS Review, AMORs, OSIPs, and Quality of Life (QOL) initiatives. Models have been developed and applied to all CF occupations and many groups of occupations. In particular, the GeM model building software is being used by CAS and CMS staff for single environment HR policy development. Medical, Dental, Security, Chaplain, Intelligence, Legal, and Communications Electronics Branch Advisors have requested HR modelling assistance in the past year.

The Future

44. There is considerable scope for expansion of HR modelling activities in the future. The prime career flow modelling environment is GeM and a large number of GeM functions remain to be exploited. For example, the software has "expert system" components that can be used to suggest new HR policies (instead of the current practice of investigating the implications of proposed policies). Developments in other software packages that may have application to HR modelling also have potential in this regard.

45. Aside from technical improvements to the software and speed/capacity improvements to the hardware, there remain opportunities for model development in non-traditional subjects (from PORT's point of view at least). In recent years, HR models have not been developed for civilian occupations and this could be done without developing new model functionality. Another desirable expansion of HR modelling techniques within PORT would be in the area of costing HR policies. That is, HR models could be tied to cost information to provide forecasts of not only demographic but also financial implications of HR policies. This area of HR modelling research has been suggested recently by the Director General Compensation and Benefits (DGCB) staff. Other possible areas for the application of HR modelling are "non-traditional" career flows (e.g. Military Universal Classification Standard (UCS)) that can be modelled to analyze the implications of implementing such policies. Also, demographic policy considerations can be modelled (e.g. employment equity groups, language, etc.) without extensive re-working of current models.

IV. THE GENERIC MODEL (GeM) UTILITY

Introduction

46. As noted previously, the GeM model building utility is the prime tool used within PORT for developing career flow models that support military HR decision-makers at both the strategic and career management levels. Career flow modelling of CF occupations, as conducted in GeM, has achieved a great deal of acceptance among HR planners and career managers. During periods of CF re-structuring and re-engineering, a vast array of personnel systemic transitions are being made - most of which require the unique range of personnel forecasts which GeM models provide to decision-makers. However, GeM is a highly technical utility requiring considerable training and expertise to operate. Analysts assigned to work in career flow modelling require considerable training and expertise to use GeM effectively.

GeM History

47. D Man A first developed GeM in the early 1990s. At the time there were four different models in use to examine personnel policies for the CF. All these models had become difficult to maintain due to the extensive reprogramming required to represent a broader range of analysis support than had previously been the case. There was a need for a more flexible software environment to replace some or all of these models.

48. The need for a new modelling approach reached a critical level when an impact analysis was required for a proposed career progression process known as Trade Advancement through Skill and Knowledge (TASK). TASK models would have to represent career flows with both upward and lateral flows (i.e. through promotion and/or technical knowledge) as opposed to the simple upward rank progression of other D Man A models. Such HR models would also have to support structural differences between different MOCs as well as different promotion and attrition patterns. Also, complex multi-occupational structures may be affected by split or merge points.

49. To address these issues a commercial organization was contracted to design the initial specifications for this unified modelling environment while an unrelated consulting group did the majority of the software development. More recently, an independent consultant, formerly of the latter consulting group, has been responsible for the last few versions of GeM. The most recent issue of GeM (version 6) will continue to be employed to support client requirements for the indefinite future.

50. GeM was designed for extreme flexibility, at the cost of user-friendliness. Other tools in use at the time could not satisfy the PMO TASK requirement, even with major modifications. Over the past decade there have been numerous "blue-sky" proposals for HR policies which have been analyzed using GeM and this requirement is not expected to diminish. Therefore, any other modelling technique that might replace GeM in the future would have to be as powerful and flexible as GeM is today.

GeM Funding

51. Early development funding for GeM was split between PMO TASK and DGOR. Total funding from all sources has now exceeded half a million dollars. However, all resources for GeM software development since 1993 have come from DGOR. Over the past two years, DGOR has:

a. provided about $150,000 in contract funds to enhance the capabilities and speed of GeM;
b. funded a contract to develop help menus and learning guides to facilitate the transfer of knowledge;
c. upgraded the computer platforms on which GeM runs;
d. funded a series of co-op students to provide some additional support;
e. arranged for a seconded funded Turkish officer with modelling experience to join PORT for one year; and
f. funded participation of analysts at an international conference in Australia and a meeting in the US to explore collaborative research possibilities, the sharing of models and to provide professional development.

52. These initiatives have improved model development and processing time considerably. However, co-op students and exchange officers provide assistance at a very junior level, come with significant training requirements and do not provide a long-term solution. At this point, DGOR is of the view that clients should provide future development funding.

GeM Concerns

53. After a decade of evolutionary development, the future of the GeM methodology was evaluated (on a preliminary basis) in Reference 11 - both from the point of view of client requirements and taking into account recent advances in software design. That study presented an analysis of GeM functionality and made recommendations about its

continued use as a modelling tool for the CF. As a result of this review, it was proposed that further development of the GeM software be suspended while other modelling approaches are investigated. Key issues in the suggested research are relevance to military HR studies, technical supportability and the learning curve for new and experienced HR analysts. While this is taking place, GeM will continue to be the prime military HR model building environment within the PORT. Thus, efforts to improve GeM documentation will continue.

Resource Issues

54. With the reduction of DS personnel allocated to ADM HR-MIL support and significant downsizing of ADM HR-MIL staff, only one DS is fully cognizant of all the capabilities contained in GeM. Several other DS analysts have either a secondary familiarity with the current version of GeM or considerable familiarity with early versions of GeM. Also, several junior officers and senior NCMs have been trained to run GeM, but they do not have the experience or analytical training to conduct effective research with the software.

55. GeM was developed using the PROLOG language and (as a result of higher priority development issues) has not yet been documented well enough to be a self-contained package. That is, considerable hands-on experience is required before a new analyst can claim to be fully functional with the methodology. A proper training course has not as yet been developed for the most recent versions of GeM.

56. Reference 11 presented a technical critique of GeM which included an overview of some issues which require resolution with respect to its future employment. It was recommended that a study be conducted to answer the following questions in some detail:

a. What is GeM capable of doing;
b. Which GeM functions are/are not required to satisfy client requirements; and
c. What are the prospects for change in the above (e.g. can the CF live with less functionality, is more needed, etc.)?

57. Research is required to allow departmental management to decide whether or not to continue funding development of GeM or to invest in another approach to

providing equivalent functionality with fewer resources dedicated to develop proficiency in model use. The estimated cost of the proposed study is $100000 for a contract, spanning from 6 months to a year of effort, depending on the expertise of the contractor. Alternatively, an experienced DS could do this project (in house) if he or she were able to devote approximately the same period of time to the study. Support from software/systems experts inside or outside of DGOR might be required in this case. Funding support could be split between a number of clients or alternatively, ADM HR-Mil could fund this study centrally. If so, the project should be inserted in the appropriate Business Plans as soon as a decision to go ahead is made.

DS Career Progression Issues

58. The type of modelling done by PORT DS staff requires considerable experience to effectively apply complex constraints and interpretations of military HR policies to computer models and subsequently to extract results from these models and distill useful advice for HR managers. This type of work combines requirements for modelling skills, mathematical and computer science knowledge as well as a familiarity with military HR issues. This expertise is not easily developed without proper DS career development and succession planning.

59. If senior DND/CF managers require timely information, forecasts, analysis of proposed policies, etc., there has to be relevant expertise available on a continuing basis. HR modellers must have the experience, data and analytical tools immediately available to them or else there will be substantial delays in satisfying requests for support. Any resources available for "surge" analysis can be gainfully employed meeting more routine client requirements for analytical support, as the demand exceeds available resources for such work.

60. The PORT modelling group requires a critical mass for effective peer review. There must be time allocated to documenting completed work and archiving this information into the corporate knowledge of DGOR. This time cannot always be spared by the demands currently faced within PORT. Also as discussed previously, some time should be spent working in methodological development or else DS staff would cease to develop professionally. If the DS analyst assignment in PORT becomes mired in routine, then both the team and the individual face bleak prospects in the long-run. DND should carefully guard its expertise in military HR modelling to ensure that it does not shrink below the critical mass required to maintain viability in the future.

61. In view of the above, a developmental position should be established for a DS analyst to become familiar with career flow modelling and to provide succession planning for current DS "modellers" in PORT. The establishment of such a position would also address concerns about the team's heavy volume of analytical work. Also, the addition of another analyst would free up some time for senior analysts to carry out more innovative research and development in this area.

V. SUMMARY

62. The size and nature of CF military occupations are changing as a result of significant re-structuring and re-engineering during the 1990's. The increasing number of requests for PORT modelling assistance is evidence that the need for systematic, analytical input to support HR policy decision-makers is growing. Also, the impact of these modelling results is growing. This paper has illustrated this with examples of models applied to the following types of issues:

c. Occupational restructuring support;
d. Terms of Service analysis;
h. Demographic studies;
i. Support for career management;
j. Database development;
k. Attrition analysis; and
l. Methodological research.

63. This paper has demonstrated how HR modelling has supported decision-makers in DND and the CF in the recent past by giving a number of examples of sponsored studies in a wide variety of military HR policy domains. These examples have included reasons for carrying out the studies, brief synopses of results and how these results have been applied to issues of concern to HR managers. Thus the utility of HR models to DND and the CF has been clearly established.

64. A number of issues and concerns relating to the current state of PORT modelling capabilities have been raised. These range from concerns about the technical state of current modelling tools to resource allocation questions to career progression issues

within the DS community. Suggestions have been made to extend the suite of PORT HR modelling tools and pursue studies in new HR-related areas, providing that resource managers see the need for such activities. In particular, a decision must be made to either continue the development of GeM as the prime HR modelling methodology or to develop the equivalent capability in a more supportable environment.

VI. RECOMMENDATIONS

65. It is recommended that:

a. a research project be funded to carry out the substantive analysis required by DND/CF to make an informed decision to either continue the development of GeM as the prime military HR modelling methodology or to develop the equivalent capability in a more supportable environment; and

b. a developmental level analyst position be established to become familiar with career flow modelling, alleviate the heavy burden of work which is currently falling upon PORT modellers and to provide succession planning for these analysts.

REFERENCES

1. Jesion, Dr A. and Kerzner, L.F., An Assessment of the Implications of Rank Inversion on Occupational Sustainability, DOR(CAM) Research Note RN-9911, July 1999.

2. Kerzner, L.F. and Jesion, Dr A., Development of a New Long Range Planning Model, DOR(CAM) Research Note RN-9904, March 1999.

3. Jesion, Dr A. and Kerzner, L.F., Population Flow Implications of Eliminating the Compulsory Retirement Age, DOR(CAM) Research Note RN-9905, April 1999.

4. Jesion, Dr A. and Kerzner, L.F., An Assessment of the University Degree Policy for Canadian Forces Officers, PORT Research Note RN-9707, September 1997.

5. Jesion, Dr A. and Kerzner, L.F., Models of Canadian Forces Officer Occupations Most Affected by University Degree Requirements, DOR(CAM) Research Note RN-9806, May 1998.

6. Jesion, Dr A. and Kerzner, L.F., Forecasting the Age Distribution of the Canadian Forces, DOR(CAM) Research Note RN-9820, November 1998.

7. Kerzner, L.F. and Jesion, Dr A., Human Resource Modelling in Support of the Establishment of a new Military Occupation: Tactical Acoustic Sensor Operator, DOR(CAM) Research Note RN-9909, May 1999.

8. Kerzner, L.F., Jesion, Dr A. and Chan, Dr G.H., A Strategic Military Personnel Database for Desktop Computers, DOR(CAM) Research Note RN-9801, February 1998.

9. Jesion, Dr A. and Winiszewska, M., A Comparative Analysis of Attrition Rates in the Radio and Teletype Operator Occupations by Rank and Gender, DOR(CAM) Research Note RN-9913, August 1999

REFERENCES (continued)

10. Kerzner, L.F. and Jesion, Dr A., Intrinsic Variability of GeM Measures of Personnel System Performance, DOR(CAM) Research Note RN-9707, November 1997.

11. Lee-Shanok, B., and Jesion, Dr A., A Technical Assessment of the Generic Modelling Utility, DOR(CAM) Research Note RN-9907, May 1999.

DOCUMENT CONTROL DATA
(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

1. ORIGINATOR (the name and address of the organization preparing the document. Organizations for whom the document was prepared e.g. Establishment Sponsoring a contractor's report, or tasking agency, are entered in Section 8).

PERSONNEL OPERATIONAL RESEARCH TEAM, ADM HR-Mil, NATIONAL DEFENCE HQ, OTTAWA, CANADA, K1A 0K2

2. SECURITY CLASSIFICATION (overall security classification of the document, including special warning terms if applicable)

Unclassified

3. TITLE (the complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title)

The Requirement for Military Human Resource Models (U)

4. AUTHORS (last name, first name, middle initial)

Jesion, Dr Abe

5. DATE OF PUBLICATION (month Year of Publication of document)

January 2000

6a. NO OF PAGES (total containing information. Include Annexes, Appendices, etc.) 22

6b. NO OF REFS (total cited in document) 11

7. DESCRIPTIVE NOTES (the category of document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

Project Report

8. SPONSORING ACTIVITY (the name of the department project office or laboratory sponsoring the research and development. Include the address).

Chief of Staff ADM HR-Mil

9a. PROJECT OR GRANT NO. (if appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)

NIL

9b. CONTRACT NO. (if appropriate, the applicable number under which the document was written.)

NIL

10a. ORIGINATOR's document number (the official document number by which the document is identified by the originating activity. This number must be unique to this document.)

ORD PROJECT REPORT PR 2000/07

10b. OTHER DOCUMENT NOS. (Any other numbers which may be assigned this document either by the originator or by the sponsor.)

11. DOCUMENT AVAILABILITY (any limitations on further dissemination of the document, other than those imposed by security classification.)

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This report examines a wide range of issues related to military Human Resource (HR) modelling activities as conducted within the Personnel Operational research Team (PORT). By examining a number of recent case studies, it is demonstrated that there is a strong and ongoing requirement for HR modelling to support military HR policy development in DND. A number of issues and concerns relating to the current state of PORT modelling capabilities are raised. These range from concerns about the technical state of current modelling tools to resource allocation questions to career progression issues within the Defence Scientist (DS) community. This paper provides several recommendations in this regard.

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